ADAPTIVE HYDRAULICS

A TWO-DIMENSIONAL MODELING SYSTEM
DEVELOPED BY THE COASTAL AND HYDRAULICS LABORATORY
ENGINEER RESEARCH AND DEVELOPMENT CENTER

A PRODUCT OF THE SYSTEM-WIDE WATER RESOURCES PROGRAM

AdH + CASM

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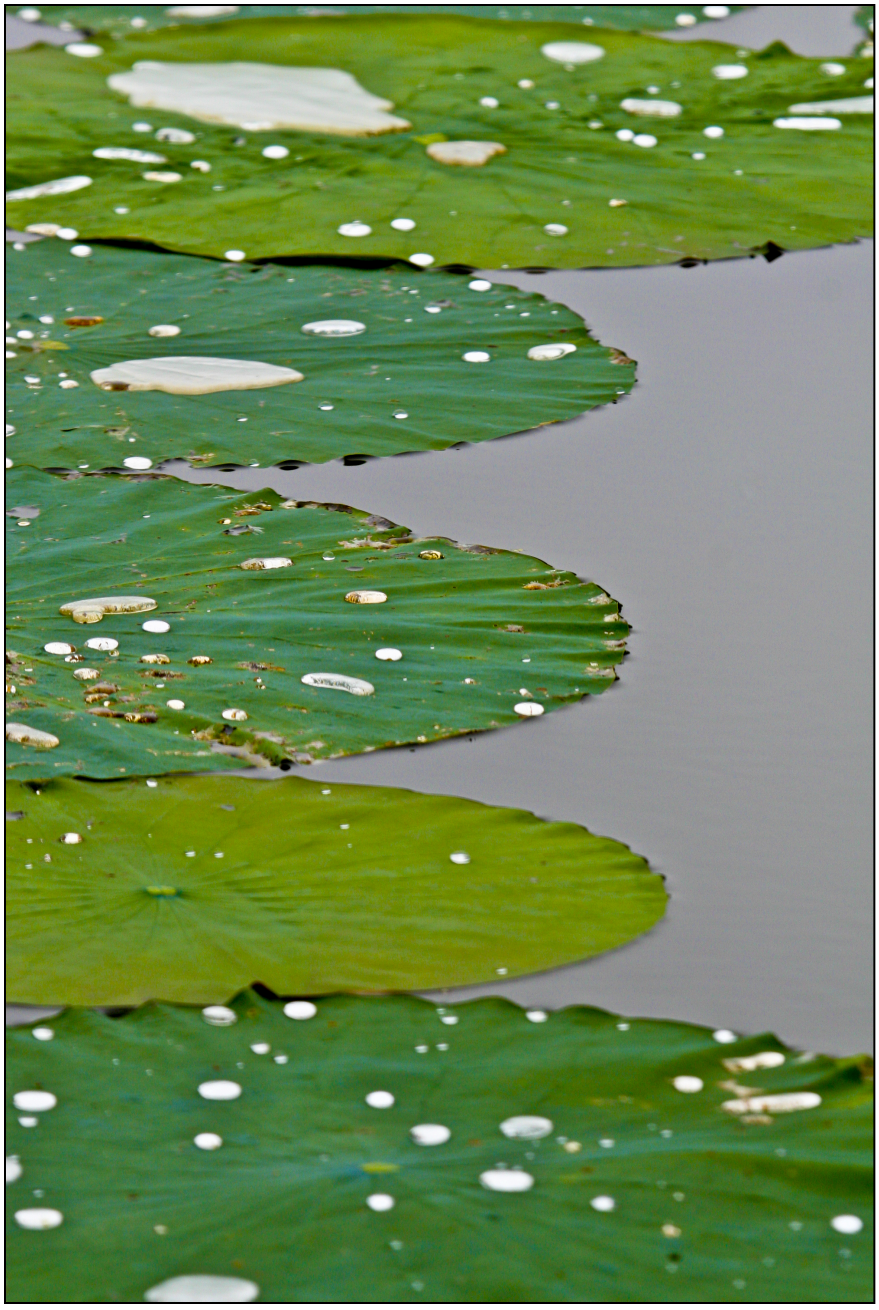
ECOLOGICAL IMPACTS DEFINED.

(Information provided by SWWRP product information sheet)



Need to define the ecological impact your project will have on its surrounding environment? Find the answers with AdH-CASM, a state of the art modeling system that integrates Adaptive Hydrodynamics (ADH) with the Comprehensive Aquatic Systems Model (CASM).

Using a grid developed through the Surface-Water Modeling System (SMS) to view and analyze results, ADH will internally calculate flows, velocities, depths, and transported and non-transported constituents while CASM will show food web structure,

bioenergetics parameters, trophic relationships and environmental functions.

One of the major benefits of AdH is its use of adaptive numerical meshes that can be employed to improve model accuracy without sacrificing efficiency. A user-generated mesh can be refined or coarsened depending on error indicators. AdH also allows for the rapid convergence of flows to steady-state solutions.

CASM is an ecological model that features habitat, biochemistry and biota. It has four producer groups, each with 10 species including phytoplankton, periphyton, macrophytes and emergent aquatic plants. It also has eight consumer groups including benthic invertebrates, fish and bacteria.

AdH incorporates CASM at the end of the advection-diffusion cycle using a 4th order Runge-Kutta scheme.

Two is better than one

The benefits of combining the two modeling systems into one framework are:

Fine Resolution: Previously ecological models have been coarse grid i.e., ecological models were run on a few static points within the area of interest, this approach while sufficient for preliminary studies is insufficient for detailed management decisions as well as for permitting processes. AdH, by incorporating CASM, has provided an unprecedented ability to provide the same fine resolution to the ecological model as that available to the hydrodynamic model.

Adaptive: AdH refines and coarsens the mesh based on error indicators. CASM benefits from improved hydrodynamic and transport results otherwise unavailable to it.

Portability: AdH can run efficiently on a wide variety of platforms. These include Windows, Unix and Linux machines, single processor machines to distributed memory supercomputers.

Implicit: AdH utilizes an implicit solution scheme. This implies that the time-step is not limited to the stability conditions imposed by the Courant–Friedrichs–Lewy (CFL) number and can take larger time-steps, hence, reducing the turnaround time on time-critical simulations.

Data Requirements

ADH as well as CASM requires a robust suite of initial data to be successfully run:

1) A description of the geometry and bed elevations of region to be modeled;

2) Data to de-scribe flows into modeled area, water elevations downstream (in most cases);

3) Description of vegetation and bed material to delineate bed roughness;

4) For sedimentation studies, a descrip-tion of bed material and boundary influx of sediment;

5) For validation, a) Hydrodynamics: flows and water surface elevations and sometimes velocity fields, b) Salinity, temperature, suspended sediment need descriptions of distribution of constituents during a set of hydrodynamic events, c) For bed morphology and sediment transport data sets showing bed elevations at different times.

CASM requires a much more thorough suite of data to be implemented. This data includes preda-tor-prey relationships, environment data, and biological data for the simulated species.

Points of Contact

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